

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
2 December 2004 (02.12.2004)

PCT

(10) International Publication Number
WO 2004/105125 A3

(51) International Patent Classification⁷: **H01L 23/58**

(21) International Application Number:
PCT/IB2004/050716

(22) International Filing Date: 17 May 2004 (17.05.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
03101515.9 26 May 2003 (26.05.2003) EP

(71) Applicant (for all designated States except US): **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **TUYLS, Pim, T.** [BE/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). **KEVENAAR, Thomas, A., M.** [NL/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). **DE JONGH,**

Petra, E. [NL/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). **WOLTERS, Robertus, A., M.** [NL/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

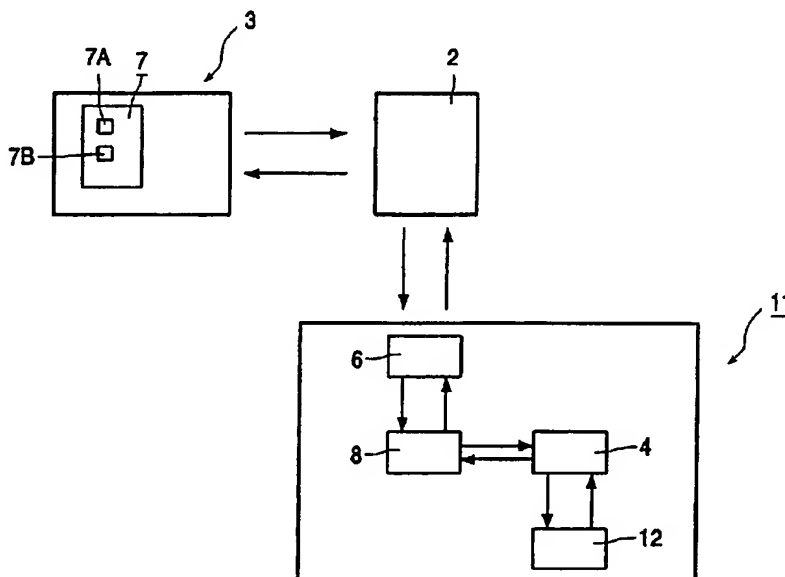
(74) Agent: **ELEVELD, Koop, J.**; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI,

[Continued on next page]

(54) Title: SEMICONDUCTOR DEVICE, METHOD OF AUTHENTICATING AND SYSTEM



(57) Abstract: The semiconductor device (11) of the invention comprises a circuit and a protecting structure (50). It is provided with a first and a second security element (12A, 12B) and with an input and an output (14, 15). The security elements (12A, 12B) have a first and a second impedance, respectively, which impedances differ. The device is further provided with measuring means, processing means and connection means. The processing means transform any first information received into a specific program of measurement. Herewith a challenge-response mechanism is implemented in the device (11) and a reader in order to check the authenticity or establish the identity of the device (e.g. smartcard).



SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

Declaration under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE,

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:

6 January 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

onal Application No

IB2004/050716

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01L23/58

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01L G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>WO 98/18102 A (POSCH REINHARD) 30 April 1998 (1998-04-30) page 1, line 8 - page 3, line 30 page 4, line 1 - page 10, line 31; figures 1-4</p> <p style="text-align: center;">----- -/-</p>	1-10, 13

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

8 November 2004

Date of mailing of the international search report

16/11/2004

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Corchia, A

INTERNATIONAL SEARCH REPORT

onal Application No

IB2004/050716

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>WO 03/007231 A (GRASSL THOMAS ; GIESECKE & DEVRIENT GMBH (DE)) 23 January 2003 (2003-01-23) page 1, lines 1-20 page 5, lines 6-16 page 7, line 14 - page 10, line 7 page 12, line 9 - page 13, line 19 page 14, line 20 - page 19, line 12; figure 1 page 20, line 28 - page 22, line 29; figure 2 page 23, line 12 - page 24, line 24; figures 3B, 3C</p>	1-7, 9-14
X	<p>US 6 161 213 A (LOFSTROM KEITH) 12 December 2000 (2000-12-12) column 1, line 39 - column 3, line 20 column 4, line 9 - column 5, line 8; figure 1 column 5, lines 16-52; figure 2 column 10, lines 51-62; figure 14 column 12, lines 9-67 column 14, line 29 - column 15, line 19; figure 20 column 15, line 65 - column 16, line 7</p>	1, 2, 9-14
X	<p>US 6 047 068 A (RHELIMI ALAIN ET AL) 4 April 2000 (2000-04-04) column 1, line 48 - column 2, line 40 column 3, lines 10-38 column 4, lines 5-39; figures 1, 2 column 4, line 40 - column 5, line 37; figure 3</p>	1, 2, 5, 6, 9, 10
P, X	<p>WO 03/046986 A (PEEK HERMANUS L ; ROKS EDWIN (NL); DE JONGH PETRA E (NL); KONINKL PHIL) 5 June 2003 (2003-06-05) the whole document</p>	1-14
A	<p>CA 2 344 429 A (FRAUNHOFER GES FORSCHUNG) 30 March 2000 (2000-03-30) pages 2, 3A-4 pages 5, 6; figure 1 pages 10-14; figure 4</p>	1-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

IB2004/050716

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9818102	A	30-04-1998	AT 408925 B AT 185896 A WO 9818102 A1 AU 4542997 A EP 0993653 A1	25-04-2002 15-08-2001 30-04-1998 15-05-1998 19-04-2000
WO 03007231	A	23-01-2003	DE 10133855 A1 WO 03007231 A1 EP 1410319 A1 US 2004193877 A1	30-01-2003 23-01-2003 21-04-2004 30-09-2004
US 6161213	A	12-12-2000	CA 2362962 A1 CN 1346473 T EP 1203329 A1 JP 2002537646 A TW 449846 B WO 0049538 A1	24-08-2000 24-04-2002 08-05-2002 05-11-2002 11-08-2001 24-08-2000
US 6047068	A	04-04-2000	FR 2738970 A1 FR 2738971 A1 AT 187271 T DE 69605445 D1 DE 69605445 T2 EP 0861479 A1 WO 9711442 A1 JP 11514466 T	21-03-1997 21-03-1997 15-12-1999 05-01-2000 21-06-2000 02-09-1998 27-03-1997 07-12-1999
WO 03046986	A	05-06-2003	EP 1451871 A2 WO 03046986 A2	01-09-2004 05-06-2003
CA 2344429	A	30-03-2000	DE 19843424 A1 AT 225548 T CA 2344429 A1 DE 59902963 D1 DK 1099197 T3 WO 0017826 A1 EP 1099197 A1 ES 2184500 T3 PT 1099197 T	23-03-2000 15-10-2002 30-03-2000 07-11-2002 10-02-2003 30-03-2000 16-05-2001 01-04-2003 28-02-2003